PROCEEDINGS OF THE FIRST ANNUAL WESTERN FOREST INSECT WORK CONFERENCE

Fort Collins, Colorado, U. S. A.
December 15-16, 1950.

OPENING BUSINESS SESSION

The meeting was called to order by Chairman Hector A. Richmond at 9:30 a. m. in the Assembly Room, Armstrong Hotel, Fort Collins, Colorado. All officers of the Conference were present, as follows:

Chairman	Hector A. Richmond, Victoria, B. C.
Secretary-Treasurer	Philip C. Johnson, Coeur d'Alene, Idaho.
Counsellors:	
1 - year	A. J. Jaenicke, Portland, Oregon
2 - year	George R. Hopping, Calgary, Alberta.
3 - year	Leslie W. Orr, Ogden, Utah.

Delegates to the conference (see attached roster) were welcomed by Chairman Richmond and by Dr. Noel D. Wygant, Entomologist in Charge, U. S. D. A. Forest Insect Laboratory, Fort Collins, and host to the conference, after which all delegates were introduced.

Greetings were read from Dr. W. J. Chamberlin, Oregon State College, Corvallis, and from Mr. J. J. de Gryse, Forest Insect Investigations, Ottawa, Ontario, Canada.

A nominating committee consisting of Mr. A. J. Jaenicke and Mr. George R. Hopping was appointed by the Chairman to name a candidate for counsellor in place of Mr. Jaenicke whose one-year term of office expired.

The time and place of the 1951 conference was discussed. Victoria, B. C. was suggested, the time late in October to coincide with the annual meeting of the Canadian Institute of Foresters. Portland, Oregon, was suggested as of December in conjunction with the annual meeting of the Western Forestry and Conservation Association. Mr. Jaenicke moved the 1951 conference be held in Portland prior to or following the Western Forestry and Conservation Association meeting. Mr. George Struble seconded the motion. Motion carried.

PROGRAMME SESSION

The following is a brief digest of the topic discussions that comprised most of the conference programme.

Bark Beetle Problems and Control Strategy

(Dr. Noel D. Wygant, Discussion Leader)

Dr. Wygant stated that bark beetles are foremost in the minds of western forest entomologists. He reviewed the development of bark beetle control, mentioning specifically the Black Hills beetle control project in 1906 and the Southern Oregon - Northern California western pine beetle (Dendroctonus brevicomis Lec.) control operation in 1921, as some of the first large-scale applied control programmes. Methods of controlling the mountain pine beetle (D. monticolae Hopk.) were traced through cut-peel-burn solar heat, burning standing, bark penetrating insecticides on felled and standing trees, water emulsions, and other treatments. The main objective today is to control bark beetles by silviculture and forest management.

Natural enemies of bark beetles - woodpeckers, entomophagus insects, nematodes, diseases, low temperatures - were discussed as were the more important bark beetle species themselves.

Dr. Wygant then called on delegates from various geographic regions represented to discuss current bark beetle infestations.

Province of Alberta (Mr. George R. Hopping)

No current bark beetle infestations of importance. Kootenay National Park, first serious outbreak, 1930-42, mountain pine beetle in lodgepole pine. Control not warranted because of economic conditions. Infestation ran through successive age groups; trees less than 5 inches d. b. h. not attacked. All trees over 5 inches attacked and killed, thus releasing Engelmann spruce understory.

Banff - Lake Louise area. Infestation of mountain pine beetle in lodgepole pine, 15,000 acres, 1941-43, 30,000 trees treated by conscientious objectors. Treating method; infested trees felled, bucked into short log lengths, decked, and burned.

Current wet climatic cycle probably cause of little or no bark beetle activity in the province.

(Jaenicke) What factors caused above infestations?

(Hopping) Growth rate in all age classes on decline. Mean precipitation declined during period 1920-35. Eighteen inches average annual rainfall needed for lodgepole pine. Large mountain pine beetle infestations in lodgepole pine have occurred in western British Columbia during droughts.

(Wygant) Black Hills beetle (D. ponderosae Hopk.) outbreaks in past during droughts, but recent ones during wet periods.

(Massey) Annual precipitation not conclusive; that during growing season more indicative.

(Struble) Other factors such as windfalls often override precipitation effects.

(Hopping) Banff outbreak not increased by persistent lodgepole needle miner (Recurvaria milleri Busck.) infestation. No bark beetle infestations recorded in lodgepole pine stands under 100 years old. Above Kootenay National Park and Banff outbreaks on better pine sites.

(Whiteside) Western pine beetle outbreaks in ponderosa pine in Oregon in 1920's and 1930's apparently related to precipitation deficiencies. Ponderosa pine growth rate declined to below-normal levels until 1940. No western pine beetle epidemics in Oregon or Washington since 1940.

Three current mountain pine beetle infestations in lodgepole pine forests in the Kootenay region. No control being done because of inaccessibility of areas.

Engelmann spruce beetle (D. engelmanni Hopk.) infestation in Engelmann spruce now current, in a small area of selectively-logged Engelmann spruce in the Kamloops Forest District. Infestation built up in residual stand left after logging. Many of these trees wind-thrown and first indication was that beetle infestation developed in the blowdown timber. Due to 2-year life cycle of beetle evidence suggests that infestation may have stemmed from logging slash one year prior to blow-down. Overwintering broods protected from low air temperatures by deep snows.

The Douglas fir bark beetle (D. pseudotsugae Hopk.) is a serious problem in the hemlock looper, Lambdina fiscellaria (Guen.) areas, in the province. Present beetle infestations now declining; appear to build up immediately following logging, then subside.

(Jaenicke) How about western pine beetle in ponderosa pine?

(Richmond) None since 1920-30.

(Jaenicke) Is mountain pine beetle emerging from lodgepole pine a hazard to ponderosa pine?

(Richmond) Infestations in the province have changed in time from those caused by the western pine beetle to those caused by the mountain pine beetle coincident with nearby mountain pine beetle infestations in lodgepole pine.

(Jaenicke) The earliest attempt to control the mountain pine beetle in lodgepole pine forests in Oregon (Blue Mountains) was for the purpose of protecting intermingled ponderosa pine from this beetle. Since then

have observed no indications of lodgepole pine-bred mountain pine beetle broods attacking ponderosa pine.

(Johnson) Heavy losses in ponderosa pine from attacks of the mountain pine beetle occurred on the Bitterroot and Beaverhead national forests (Montana) concurrent with the now famous Big Hole Basin infestation of this beetle in lodgepole pine in the period 1926-1933. The two tree species were intermingled on the Bitterroot and the ponderosa pine on this forest was not too distantly separated from the main lodgepole pine infestation in the Basin on the Beaverhead forest. The 1949 Thompson River Insect Control Project (Cabinet National Forest, Montana) involved the treatment of 19,150 mountain pine beetle-infested lodgepole pine trees on 22,500 acres for the purpose, in part, of preventing the attack of intermingled ponderosa pine stands by lodgepole pine-bred populations of this beetle.

(Wygant) Mountain pine beetles have emerged from whitebark pine to attack lodgepole pine in Colorado.

(Orr) Current Black Hills beetle infestations in ponderosa pine are surrounded by mountain pine beetle infestations in lodgepole pine in the Wasatch Mountains of Utah. Black Hills beetle infestation being controlled solely to protect ponderosa pine.

(Wygant) Douglas fir beetle infestations in Colorado Douglas fir followed defoliation of trees by the spruce budworm (Choristoneura fumiferana Clem.), but 80 per cent of the overwintering adults died.

(Johnson) The Douglas fir beetle problem in Idaho and Montana is associated with logging slash and sporadic cuttings of many small semi-portable railroad tie sawmills.

(Richmond) Douglas fir beetle infestations built up rapidly in coastal portion of British Columbia following extensive defoliation by the hemlock looper, but these died down quickly.

(Whiteside) Douglas fir beetle infestations often develop after logging operations in Oregon and Washington.

Oregon and Washington.

Control of bark beetles in Oregon and Washington has largely been concerned, since 1910, with the control of the western pine beetle in ponderosa pine. Direct control has given way to recently developed indirect control methods now widely employed in this region. The method employs "sanitation-salvage" logging to remove the green insect-susceptible trees from the stand. These cuttings employ two methods of marking the trees susceptible to beetle attack; (1) the ponderosa pine risk rating system for short-term beetle protection and (2) the Keen susceptibility classification for long-term protection.

Current infestation conditions in this region shows (1) no western pine beetle outbreaks, (2) two mountain pine beetle outbreaks in lodgepole pine, and (3) an infestation of Pseudohylesinus spp. in the vicinity. Another infestation of this beetle in the Deschutes area (Oregon) showed 42,000 lodgepole pine trees infested in 1950. The infestation is spreading southward toward California. Efforts of several State and Federal forestry agencies are attempting to determine the cause of the outbreak. Control recommended for 1951.

The Pseudohylesinus outbreak in Washington is spread over 100 local areas totalling about 100,000 acres. No control recommended.

(Jaenicke) Why no control?

(Whiteside) Areas too inaccessible and infested trees not always visibly evident.

(Jaenicke) Past infestations, if they occurred, may have been overlooked because silver fir was not economically important.

(Whiteside) Mountain pine beetle infestations in region also difficult to control because of inaccessibility of infested areas. Pulp companies and small sawmills may salvage infested lodgepole areas.

(Jaenicke) Pseudohylesinus difficult to control because brood may be confined to upper bole and thus not detected until needles fade and drop. This may be too late due to emergence of new adult beetles by this time. Also, the beetles attack in patchwork fashion along bole. The resultant dead areas of cambium exposed by emergence faster than normal because of this. Dead silver fir not desirable for pulpwood. Current outbreak of this species is a good example of a secondary insect becoming primary and noticeable only when host tree becomes economically important.

Oregon and Washington have been free of serious mountain pine beetle outbreaks in lodgpole pine since 1927. It is important to control these outbreaks while in their incipiency. The 1949-50 winter mortality of the beetle broods was not too significant though air temperatures reached -40 degrees F. There is an increased demand for lodgpole pine as lumber and pulpwood, but foresters hesitate to control mountain pine beetle in these stands because the patchwork of age classes precludes sustained yield management.

(Thatcher) Pseudohylesinus comes very close to being primary in nature in red fir (A. magnifica A. Murray) at Yosemite National Park (California).

(Whiteside) Present mountain pine beetle infestation in lodgepole pine in Oregon with groups of as many as 40-50 infested trees. Though this outbreak has existed for several years nearby ponderosa pine stands have not been infested.

(Parker) Large areas of insect-killed lodgepole pine become great fire hazards.

(Massey) How heavy are the broods of mountain pine beetle in lodgepole pine?

(Struble) Probably 175 per square foot of infested bark surface.

(Johnson) Can't pulp companies be interested in large-scale salvage of mountain pine-beetle-infested lodgepole pine in Oregon?

(Whiteside) Companies have cheaper more accessible pulpwood species to draw upon.

(Hopping) How are lodgepole pine stands established in Oregon?

(Jaenicke) In openings in ponderosa pine stands caused by group-killing of trees by the western pine beetle. In pure lodgepole pine stands the cover type was either always lodgepole pine or once all ponderosa pine.

(Johnson) Lodgepole pine stands established by fires in Idaho and Montana.

(Struble) How bad are Ips outbreaks in Oregon and Washington?

(Whiteside) 1950 was a bad Ips year. Many small localized outbreaks.

California (Mr. George R. Struble)

Infestations of the western pine beetle in ponderosa pine increased appreciably in 1950, though all are local and not too large. Most are in the central and southern parts of the State where they are light to moderately epidemic, sporadic, and with groups of up to 25 infested trees. Apparent disregard of age or vigor of infested trees on the part of the beetle. The volume per acre killed in 1949 and 1950 about twice as heavy as in 1940-50 decade. Total loss from this insect estimated to be 400 to 600 million board feet in 1950. Direct control projects are recommended for a number of areas south of the Tuolumne River. Drought conditions in southern California probably responsible for current beetle activity there. Lack of beetle activity in north-eastern California undoubtedly due to extensive use of sanitation-salvage logging, as an indirect control method, in recent years.

(Merkel) What are the records of bark beetle activities following the big forest fires in California in recent years?

(Struble) Bark beetles breed readily in fire-scorched trees the second year after the fire. Heavy killing of standing trees by

beetles on periphery of burn soon follows. Such infestations are short-lived in green forests.

(Massey) Have you used orthodichlorobenzene bark penetrating sprays on thin-barked ponderosa pine for western pine beetle control?

(Struble) Yes, at present in southern California, but brood mortality is still variable due to changing bark thickness. Fumigation effect of the ortho is good.

(Massey) Ortho is not good in thick-barked trees?

(Struble) Right. We have never been able to treat trees standing as is done with lodgepole pine in the Rocky Mountain States. A combination of oiling and burning might be applied to the boles of felled infested trees.

(Jaenicke) Light western pine beetle infestations might be misleading. Ordinarily they cause mortality of less than 1 or 2 per cent of the stand volume per year, but their persistent nature soon builds up an appreciable mortality volume.

(Wygant) It seems advisable to report a state wide drain figure for insect losses if it can be done.

(Johnson) Spraying standing treatment of mountain pine beetle-infested lodgepole pine as practiced in the Rocky Mountain States has limitations which are particularly evident in the treatment of ponderosa pine in California; namely (1) height of broods in infested boles, (2) over-all height of infested trees, (3) thickness of bark, (4) absorbing qualities of the bark, and (5) maximum height reached by present spraying equipment.

Intermountain Region (Mr. Leslie W. Orr)

(Region includes southern Idaho, Nevada, Utah, northern Arizona, and the western parts of Wyoming and Colorado. PCJ).

Outbreaks of the mountain pine beetle in lodgepole pine have continued for many years in the Ashley and Wasatch national forests (Utah). Control was conducted yearly during the 1930's, but abandoned during World War II despite continued epidemic infestations. Present infestations still epidemic. This highlights a weakness of many control policies - a heavy investment in control programs sometimes abandoned for non-entomological reasons. Losses in the current outbreak are averaging 100,000 trees per year; not great as volume goes, but important because the area is one of the few sources of merchantable lodgepole pine in the region. Use of this species for pulpwood and smelter and mine converter poles and timbers is increasing rapidly. Control of above current outbreaks still desirable as well as those on several smaller areas in southern Idaho and Utah.

Engelmann spruce beetle infestations are current in spruce stands in the Payette National Forest (Idaho). Started from windfallen trees, as so many of these outbreaks do. Controlled in 1949 and 1950.

Black Hills beetle infestations in ponderosa pine are increasing in the Dixie National Forest (Utah). Three thousand, seven hundred trees killed 1950. Control by salvaging infested trees is planned.

The most perplexing bark beetle problem is in the ponderosa pine stands of the Boise National Forest (Idaho) where current infestations of the western pine beetle and the Oregon engraver beetle, Ips oregoni (Eich.) in 1949 and the pine beetle alone in 1950 are associated with a severe infection of ponderosa pine needle blight fungus, Elytroderma deformans (Weir) Darker. This may prove to be the beginning of a major pine beetle epidemic. Timber owners are much concerned because the area is under intensive forest management and cutting budgets may have to be greatly modified or abandoned altogether to control the insects or to salvage the blight-killed trees.

The Douglas fir bark beetle has caused greater losses in the region over a period of years than any other bark beetle. Lack of adequate control measures precludes any reduction in tree mortality now unless a natural decline in the infestations occurs.

(Wilford) How are Engelmann spruce beetle infestations treated in this region?

(Orr) By spraying an orthodichlorobenzene-oil mixture to the basal portion of infested standing trees, and to windfalls and chunks.

(Jaenicke) Large areas of needle blight-infected ponderosa pine are being forced into the timber market in Oregon; cutting up to 70 per cent of the stand volumes. As yet, no western pine beetle infestations have developed, probably because heavy sap concentrations in the boles of the infected trees may be thwarting successful beetle brood development. The beetle attacks but produces no broods. This may be different than the situation on the Boise National Forest.

(Orr) In one area of 3,500 acres in the Boise Forest needle cast infection zone 32,000 trees are currently infested by the pine beetle.

(Richmond) The benefits of sanitation-salvage logging to control the pine beetle may be wiped out by the effects of the needle fungus.

(Jaenicke) This indicates that some of the past big bark beetle outbreaks in the west may have been associated with epidemic infections of pathological organisms.

(Johnson) There is still the possibility that the pine beetle outbreak on the Boise Forest may be independent of the needle blight.

Central Rocky Mountain Region (Mr. E. P. Merkel)

(South Dakota, eastern parts of Wyoming and Colorado. PCJ)

The Black Hills beetle is currently epidemic on the Bighorn National Forest (Wyoming), killing 35,000 ponderosa pine trees on 4,300 acres in 1950. Extensive areas of lodgepole pine nearby remain unattacked. No control is planned because of indifference of the many owners. The same beetle killed 40,000 ponderosa pine trees on parts of the Roosevelt National Forest (Colorado) in 1949; many large groups, all pine stands on some 640 acre tracts 70 per cent killed. Some of the infestation was treated in 1950 for aesthetic reasons and because of the proximity of uninfested pine stands in nearby Rocky Mountain National Park. Bark beetles have long been a serious problem on this forest.

The Douglas fir beetle has caused appreciable tree mortality following initial defoliation by the spruce budworm in the Estes Park area of the above national park. The trees are being controlled because of their aesthetic value though many are exceedingly difficult to reach because of the rugged terrain.

In 1950, an infestation of the roundheaded pine beetle, D. convexifrons Hopk., killed 16,000 pole-sized ponderosa pine trees on 6,000 acres in the Lincoln National Forest (New Mexico). The area has previously been infested by this beetle, 50,000 trees having been treated in a 1936-38 control program. Primary attacks of convexifrons are being followed by attacks of Ips boregini (?), I. knausi SW., and I. integer (Eich.). Most pine beetle-attacked trees border roads and Douglas fir type. Precipitation adequate in infested area. More studies needed on the life history, epidemiology, and control methods of this pine beetle.

(Orr) Do the convexiforns infestations result in a complete killing of the pine stands?

(Merkel) They may kill the entire stands, taking dominant as well as suppressed trees. The infestations are restricted to the pine stands on the south slopes. Douglas fir occupies the north slopes.

New Mexico and Arizona (Dr. B. H. Wilford)

A number of small, endemic Engelmann spruce beetle infestations are scattered through the region, many resulting from blowdowns of Engelmann spruce forests. None is serious and many are being salvaged by lumber companies.

The fir engraver, Scolytus ventralis Lec., has been causing some mortality of Douglas fir trees in areas where previous spruce budworm

defoliation has occurred or where trees have been cleared for ski runs. Orthodichlorobenzene-oil mixtures (1:6) have been sprayed on the bark of the felled infested trees and excellent control has resulted.

No other bark beetle infestations of importance are current in the region.

The national forest administration in this region is very cognizant of the bark beetle and other insect problems. Forest rangers are always alert to the appearance outbreaks and do a fine job of reporting them to the forest insect laboratory. More knowledge needed of the life history, infestation habits, and control methods of beetles in the region.

(Wygant) Approximately 70,000 trees infested by the Black Hills beetle were treated by direct control methods on the Harney National Forest (South Dakota) in 1946-47. Results good. Maintenance control expenditures seem legitimate to prevent further epidemic infestations.

(Orr) Maintenance insect control expenditures appears to be as justifiable as those for annual forest fire prevention and control.

Engelmann Spruce Beetle in Colorado (Dr. Noel D. Wygant)

Chronology of the current outbreak, one of the most destructive bark beetle infestations to date:

1939. In June winds of hurricane force blew down extensive stands of Engelmann spruce on the White River Plateau of the White River National Forest. These were heavily attacked by the Engelmann spruce beetle with tremendous broods being produced.

1941. The outbreak was discovered in forests of standing trees.

1943. The infestation had increased to such proportions that the beetle showed no respect for tree vigor or size. Prevailing winds had carried the infestation north eastward into remote sections of the Forest and on to the Routt and Arapaho national forests.

1943-48. Infestation gained in size while continuing to move to the north east. The serious consequences of the outbreak - namely, the complete destruction of spruce forests over vast areas - were fully realized. No control was even recommended because of (1) lack of adequate control methods, (2) lack of full knowledge of life history necessary for control, and (3) wartime shortages of man-power, equipment, and materials.

1949. By this time 3.5 billion board feet of high quality Engelmann spruce had been killed. In July, strong north-west winds carried the beetle across the Colorado River into hitherto uninfested spruce forests. Control was recommended based upon studies of the life history and of control techniques undertaken by the Fort Collins forest insect laboratory in 1944.

1950. Control was begun by the Forest Service under the technical supervision of the Bureau of Entomology and Plant Quarantine.

Engelmann Spruce Beetle Life History (Dr. C. L. Massey)

A 2-year life cycle is indicated in Colorado, though a 1-year cycle has been recorded at the lower elevational limits of the spruce type and a 3-year cycle is suspected at extremely high elevations. Briefly, the life history is as follows for the 2-year cycle:

Attack period: July. Parent adults: Large percentage re-emerge following egg laying. Some re-attack but most of them hibernate in the base of infested trees along with newly emerged adults. Larvae: Develop to ½- to 3/4-grown larvae by the time the first winter is reached. They hibernate in their galleries. Pupae: this stage reached the July following the year of attack. New adults: emerge in August or September one year after attacks made. They go into hibernation to pass the second winter beneath the bark at the unattacked base of the infested tree from which they emerged. They are sexually immature at this time. They re-emerge in June of the second year following the original attacks. As may be seen, there is apt to be quite an intermingling of different-aged adult beetles in a given tree.

Control of infestations in the winter can be limited to the lower 4 feet of the bole where the hibernating adults are located. Woodpeckers are invaluable as a natural control factor and infested trees are literally shaved of their outer bark by the birds in their search for beetles as food. Studies of the stomach contents of wood peckers showed that 95 per cent of them were made up of Engelmann spruce beetles during the summer. Single examinations of the contents averaged 25 adult beetles during the winter, 110 larvae in the winter.

(Wygant) Adult beetles cannot survive temperatures below -15 degrees F., hence they probably seek the basal portions of the infested trees where they will be protected during hibernation from the cold by reason of the thicker bark and deep snow.

(Orr) Adults may concentrate in basal region of boles because of possible greater cambium moisture.

(Wygant) Squirrels are also reported feeding on Engelmann spruce beetle larvae in winter. The hibernating adult galleries in the ploem are star-shaped.

1949-50 Engelmann Spruce Beetle Survey and Control Programme (Dr. B. H. Wilford)

Surveys by forest entomologists in 1949 showed that the beetle infestation had swept across the Colorado River by prevailing winds. Survey disclosed 500,000 1949-attacked trees needing treatment on 34,000 acres in three national forests in 1950. Surveys made very difficult because of (1) lack of forest type maps by land-managing agencies, (2) exceedingly rough terrain and inaccessibility of many spruce stands, and (3) short time allotted for survey because of early hearings of congressional appropriation bills.

The 1950 control programme, one of the largest bark beetle control projects ever undertaken, began in June 1950 coincident with additional surveys to locate infestations needing treatment in 1951. Control handled on a separate project basis by U. S. Forest Service with technical supervision by the Bureau of Entomology and Plant Quarantine. Control terminated October 21, 1950.

Treatment was accomplished by hand pump application of insecticide to the bark of the boles of standing infested trees. The insecticide was made up of orthodichlorobenzene (1 part) and No. 1 or No. 2 burner (fuel) oil, mixed in Denver and transported by tank trucks to central storage reservoirs, thence by jeeps, weapons carriers, and pack trains to the treating crews in the woods. Treating crews were made up of 7 men: chief spotter, 2 nozzlemen, 2 pumpers, and 2 packers. Equipment for each pumper-nozzleman consisted of a 5-gallon jeep can full of insecticide (replaced by packer as used), one stirrup pump, 25 feet of oil-resistant hose, 6-foot aluminum hollow spray rod, and a No. 6 nozzle.

Boles of infested trees were treated to 1½ feet above wood peckered area with stirrup pumps capable of spraying to heights of 30-35 feet above ground. Trees were sprayed on 4 sides from the top down. Average diameter (d. b. h.) of infested spruce trees treated in 1950 was 7 to 36 inches, less than in 1949. In one area trees 2 inches d. b. h. were treated. Trees on treating strips were checked. Meyers stirrup pumps more practical than powered pumps hand carried or mounted on jeeps or power wagons. Pack horses carried four loaded jeep cans (total 20 gallons) of spray mixture with canvas to protect animals from oil burns. Hibernating adults from 1948 attacks not treated in 1950.

The 1950 control project is summarized as follows:

Trees treated:

1949-attacked		619,688
1950-attacked		164,394
	Total	784,082

Acres treated:		33,301
Amount of insecticide used:		
	Total, gallons	1,003,253
	Per tree, gallons	1.28
Cost:	Total	$1,773,155
	Per tree	$2.26
Roads construction, April 19 to September 30, miles:		
	New roads	334
	Improved existing	54
	Total	388

The 1950 survey disclosed 1,500,000 Engelmann spruce trees and 92,000 lodgepole pine trees (all infested by Engelmann spruce beetle) needing treatment in 1951. The greater number of infested trees found in 1950 over those in 1949 is believed due to the same-sized population going into trees of smaller diameters.

(Richmond) Is control proving effective in curbing infestations of this size?

(Wilford) Think so, but the life history of the beetle will delay this determination. Good treatment was accomplished and therefore good control is expected. I might add that 4.2 billion board feet of the 20 billion board feet of spruce in Colorado has been killed in the current outbreak. The spruce will be usable for pulpwood 10 to 20 years after it has been killed by the beetle. This is the principal product anticipated for most of the spruce in the state. Beetle-killed spruce is good for sawlogs for only 3 years after attack.

(Wygant) The 1951 control programme is based upon complete coverage of all known 1950 infestations.

(Jaenicke) What is the best spray period?

(Wilford) May 15 - September 30, weather permitting.

(Jaenicke) Planning for control cannot be well made on tree mortality estimates for individual units, but solely upon an estimate for the entire area to be treated.

(Wygant) Tree mortality estimates need to be based upon accurate estimates of host type acreage to be treated. This should be the forester's responsibility.

(Jaenicke) Is there any evidence that Engelmann spruce beetle infestations are cyclic?

(Wygant) No. They seem to persist until the host material is consumed. Once an epidemic has been quelled there appears to be no immediate danger of any recurrence unless some forest disturbance, such as a blow down, occurs.

(Jaenicke) All personnel on bark beetle projects of this size should be given an over-all picture of the control objective as well as training in their assigned techniques.

PROGRAMME SESSION (continued)
December 16, 1950.

The programme was resumed by Chairman Richmond at 8:30 A. M., who turned the meeting over to Mr. Whiteside.

Spruce Budworm
(Mr. John M. Whiteside, Discussion Leader)

Mr. Whiteside characterized the spruce budworm (Choristoneura fumiferana Clem.) as one of the most destructive forest insects in western North America. In opening the discussion on this topic he expressed the belief that most of the interesting problems connected with it could best be brought out in the limited time available by answering the following questions:

(1) What is the general budworm picture in western North America?

(2) What methods of survey are currently being employed and how are population trends being measured?

(3) What basic research is currently in progress on the budworm in western North America?

(4) What is the opinion of the over-all situation? Are we facing a prolonged period of outbreaks or a short cycle aided by natural control factors?

To facilitate answers to these questions Mr. Whiteside called upon delegates representing the various western forest regions of Canada and the United States.

Province of British Columbia (Mr. Hector A. Richmond)

The budworm in British Columbia follows the pattern of outbreaks in the coastal section of Oregon and Washington. The budworm is generally distributed over the province endemically. One current outbreak in the north central section covers 800 square miles and the damage varies in intensity from light to heavy. This areas was surveyed by special ground crews. Both 1- and 2-year life cycles prevail; the 2-year cycle predominates in the spruce-balsam forest type and the 1-year in Douglas fir. Flight year for moths of the 2-year budworm seems to be generally synchronized over the province. In the above mentioned 800-square-mile infestation defoliation occurs every other year. The Douglas fir outbreaks have resulted in some tree mortality, but nothing serious. No serious budworm in the coastal section of the province as yet. Research by the forest insect laboratories at Victoria and Vernon are studying (1) the 2-year strain of the budworm in subalpine areas and the 1-year phase in Douglas fir areas, (2) crossmating with 1-year strains from eastern Canada, primarily a study in genetics, and (3) climatic factors associated with the 2-year strain. In eastern Canada budworm outbreaks continue until all host types are consumed.

(Graham) Potent virus and protozoan diseases may hold down budworm damage in the west.

Idaho and Montana (Mr. Philip C. Johnson)

An estimated 2,000,000 acres of Douglas fir, chiefly on the eastern slopes of the Rocky Mountains in Montana, are defoliated from current infestations of spruce budworm. Approximately 75-100 per cent of the stands have been killed on 9,000 acres since 1948. Mortality of Douglas fir has been greatest in the Helena National Forest and of Engelmann spruce in Glacier National Park. Severe defoliation appears to occur most frequently in very dense, immature, even-aged stands of fir. In numerous instances stands of this kind have been heavily defoliated whereas the defoliation in adjoining even-aged mature stands is scarcely evident. This may be due in part to the fact that the crowns of the smaller trees are composed of a higher percentage of the current, more palatable needles.

Surveys to locate current budworm infestations and to evaluate the relative degree of damage in the region have been made by an extensive reconnaissance employing a single entomologist from the staff of the forest insect laboratory at Coeur d'Alene (Idaho) each year since 1948. This work is aided by numerous first-hand reports of new outbreaks made by technical personnel of Federal and private timberland-managing agencies. Aerial observation for this purpose, followed by ground checking, was used to cover an extensive budworm infestation in the Flathead Primitive Area in 1950.

Research work on the spruce budworm was initiated in this region in 1950. Emphasis is being placed on studies of forced emergence of hibernacula as a means of determining where control action can be directed against epidemic populations. Beginning in 1951 studies are being planned to study the build-up and decline of budworm infestations, the factors associated with these phenomena, the damage accruing from different budworm population levels, and the effects of varying degrees of defoliation upon the infested trees.

There is evidence that budworm infestations, serious as they are at present, follow cyclic tendencies. In a number of drainages on the Helena National Forest, infestations reached a peak in population and damage in 1949 and are now declining. Near Townsend, Montana, budworm feeding has been detected annually for 22 years, some years more so than in others, yet little or no tree mortality has occurred. Mortality has occurred, however, from follow-up infestations in partially defoliated trees of the Douglas fir bark beetle. In this association the damage caused by the bark beetle often exceeds that of the budworm. It is hoped that the studies under way in this and other regions of the west will provide some means of delineation between outbreaks that are potentially dangerous and in need of control and those that may subside naturally without causing serious damage.

Intermountain Region (Mr. Leslie W. Orr)
(See description of region under "Bark Beetles". PCJ)

Spruce budworm infestations in this region are small and confined to southern Idaho (host, Douglas fir and Abies grandis), southern Utah, and on the Kaibab Plateau (Arizona). Observations indicate more budworm activity in 1949-50 than in previous years. No budworm surveys or research.

California (Mr. George R. Struble)

Budworm activity has been recorded from the Warner Mountains in the extreme north-eastern section for 30 years. The damage has been insignificant.

Central Rocky Mountain Region (Dr. B. H. Wilford)
(See description of region under "Bark Beetles". PCJ)

Budworm infestations have recently been highly epidemic in Douglas fir, Abies spp., and Engelmann spruce. They are now declining, but damage is still heavy on the Carson and Santa Fe national forests (New Mexico). The younger age classes of host trees appear to be more heavily defoliated, as in Idaho and Montana. Budworm infestations

on the Cibola National Forest (New Mexico) have been controlled recently by the aerial application of DDT at a cost of $1.48 per acre. No control planned in 1951 for any areas in the region. Fir engraver infestations have followed in the wake of budworm outbreaks on the Cibola forest. Budworm surveys in the region are of an extensive nature. No research is being undertaken for this insect at present.

(Wygant) Hundreds of small budworm outbreaks come and go in Douglas fir stands of the region with little consequent damage. An outbreak of spruce budworm appeared to be serious in ponderosa pine in the Black Hills (South Dakota) in 1947, but it declined in 1948. More research is needed on the budworm in the west.

(Merkel) The Douglas fir beetle infestations are developing following budworm outbreaks on the Pike National Forest (Colorado).

(Orr) In the northern Minnesota budworm outbreaks of 1913-26, defoliation was not heavy in young stands, but only in young trees under an older overstory.

Oregon and Washington (Mr. John M. Whiteside)

Budworm infestations were recorded in Oregon between 1914 and 1944 but they were small and no damage resulted. Since 1944 infestations have grown both in intensity and extent. The growth of the present epidemic infestations of Douglas fir in Oregon and Washington is shown, by years, as follows: 1947, 710,000 acres; 1948, 1,243,000 acres; 1949, 2,267,000 acres; and 1950, 2,038,00 acres. Most of this acreage is in the Blue Mountains of north-eastern Oregon.

Surveys in Oregon and Washington have been made annually since 1947 to detect and appraise current outbreaks of the spruce budworm. Prior to 1949 they were conducted by the forest insect laboratory at Portland (Oregon). Beginning in 1949 the surveys have been a joint undertaking between the laboratory, the U. S. Forest Service, the states of Oregon and Washington, and the larger timber owners. The surveys combine aerial observation and ground checking. The more visible centers of heavy budworm defoliation are located from the air. Ground checking is employed to (1) record the extent of the infestations, (2) check year-to-year changes in infestation intensity, and (3) provide a guide for aerial observation.

The ground survey procedure involves the taking of a series of roadside samples in the main drainages of the host type. In general, sampling points are about 1 to 3 miles apart. At each sampling point the number of attacked buds is counted from three 15-inch lateral terminal twigs taken from three trees. Evidence of webbing or needle feeding is also recorded and a collection of budworm brood stages is made at each sampling point. Field forms and location maps from each sampling point are sent to forest entomologists located in various

temporary field headquarters where the data are tabulated and analyzed. From the analysis a survey report is prepared to show the location and degree of defoliation of all budworm infestations in the region.

In 1950, a total of 4,500 samples were made by 132 observers spending 159 man-days on the survey.

Aerial surveys have been used to a considerable extent in 1949 and 1950, as indicated below (Oregon and Washington combined).

		1949	1950
1.	Timbered acreage covered	49,000,000	48,229,354
2.	Air miles flown	22,275	26,580
3.	Mapping hours	172.4	182.1
4.	Ferry hours	29.9	21.1
5.	Total hours	202.3	203.2
6.	Cost, airplane rental and operation only	$2,059.03	$2,278.53
7.	Cost, per flying hour	$10.18	$11.21

The aerial surveys employ a specially-modified airplane of the Portland laboratory. The laboratory was assisted in western Oregon by an airplane and personnel of the Oregon State Board of Forestry.

The 1950 budworm disclosed the following current budworm infestation conditions:

Intensity of Infestation	Oregon	Washington
Light	870,055 acres	16,800 acres
Moderate	955,645	8,640
Heavy.....	184,045	
Very heavy	1,200	
	2,010,945 acres	25,440 acres
Total	2,036,385 acres	

Budworm control operations in Oregon and Washington began in 1948 when an experimental aerial spraying project was undertaken. Large-scale spraying programmes were carried out in 1949, when 267,000 acres were sprayed and in 1950 when 934,000 acres of infested Douglas fir forests were sprayed. Recommendations have been made to spray 1,012,000 acres in 1951. The 1950 project is summarized as follows: 1/

1/ Data furnished by Mr. A. J. Jaenicke, U. S. Forest Service, Portland, Oregon, under date of October 1, 1950.

Control Method. The insecticide was a mixture of one pound of DDT and enough fuel oil and solvent to make one gallon. The aerial spraying, done by contract flyers, distributed the mixture at the rate of one gallon per acre. Over 95 per cent of the 1950 spraying was done during the period June 21 to July 16, much later than was expected. The spraying resulted in a 99 per cent mortality of budworm larvae. The control work was done by the U. S. Forest Service and the state of Oregon under cooperative agreement and by arrangements with the private timber owners, the state of Washington and the private timber owners, the (U. S.) Indian Service, the (U. S.) Bureau of Land Management, and the (U. S.) Bureau of Entomology and Plant Quarantine. All technical matters such as timing of the control work, spray material to be used, sequence of spraying, etc., were the responsibility of the latter Bureau's forest insect laboratory at Portland.

Acreages sprayed. The areas sprayed in 1950 were divided by ownership as follows: federal, 579,689 (62 per cent); state, county, and municipal, 10,540 (1 per cent); private, 343,473 (37 per cent); total 933,702 (100 per cent).

Costs. The average cost of the control work done by the Forest Service and the state of Oregon was $1.057 per acre, exclusive of contributed time of regular employees paid from other funds. The cost per acre varied by units from $0.86 to $1.36. The expenditures, by co-operating agencies were as follows:

Federal	
100% of cost of spraying federal lands	$623,937
25% " " " " private lands	88,098
Total direct federal expenditures, exclusive of BE&PQ assistance	$712,035
State and Private Owners	
State of Oregon and private owners	$260,932
State of Washington and private owners	14,254
Total states and private owners	$275,186
Federal, States, and Private Owners	$987,221

Research work on the spruce budworm in the Oregon-Washington region include studies of (1) biological aspects, (2) spray determination period, and (3) effects of various toxicants. The latter show, for instance, that DDT spray mixtures can be reduced from 1 to 3/4 pounds per acre without decreasing insect mortality. Some work is being done also on sampling techniques to check the results of spraying. The research programme in 1949 and 1950 was conducted by the Portland laboratory with the assistance of the forest insect laboratory at New Haven (Connecticut).

(Jaenicke) The cost of spraying in Oregon and Washington during 1949-50, under provisions of the Forest Pest Control Act (passed by Congress June 1947) was set for this project as follows:

Paid by U. S.:	100%	of cost on U. S. lands
	25%	" " " private lands
Paid by States:	100%	" " State "
	25%	" " private "
Paid by private timber owners:	25%	" " their own lands

Legislation is needed by some western states to permit co-operation of state, federal, and private owners on forest insect control under the Act. Seven aircraft pilots killed on the 1950 budworm project in Oregon and Washington showed causes of accidents to be (1) inexperienced airplane pilots, and (2) inexperienced spraying contractors. Safety regulations for aerial forest spraying are being drawn up by the (U. S.) Civil Aeronautics Administration as a result of these accidents.

Fish and wildlife were not affected by the spraying at a rate of one pound of DDT per acre. Spray drifting to agricultural crop area caused some actions for damage. Supplies of DDT may be short in 1951.

(Baird) Spruce budworm research in Canada is working on natural control factors. Results are not yet conclusive. The work of the spruce budworm in Europe is similar to that in the United States, but with no serious damage. Reasons for this lack of damage are being studied for possible use in North America.

(Whiteside) There is little indication that the budworm will drift back into treated areas within 2 years following spraying, but some recurrence of budworm activity may develop the third year.

(Graham) Tests in South Africa show that aiming for 95 per cent control instead of 100 per cent will allow natural factors to build up in effectiveness.

(Parker) Parasitized spruce budworm larvae do not seem to be killed by sprays, though more work is needed on this subject to establish its validity.

Forest Insect Surveys

(Mr. George R. Hopping, Discussion Leader)

Canadian Forest Insect Survey (Mr. Hopping)

The aim of the Canadian insect survey is (1) to keep a continuous systematic watch over the forests for insect outbreaks, and (2) to

keep watch on all insects and their relationships on a statistical basis. Forerunner of the present survey was the "forest insect intelligence service" begun in 1931. This proved rather ineffective because of its complete dependence upon co-operators. The present survey was inaugurated in 1936 in parts of Canada and extended to other regions as late as 1948. All Canadian forest insect laboratories now have survey units operating under a co-ordinator at Sault Ste. Marie. In the west there have been developed two main laboratories, Calgary and Victoria. In British Columbia a sub-laboratory of Victoria is located at Vernon, handling the interior portion of the province. The survey unit of the Calgary forest insect laboratory is typical (see Figure 1.).

Field sampling by the insect rangers is of two types: (1) random and (2) permanent plots. In the random sampling the foliage of 10-12 trees per locality is raked over sheets. The live insects thus collected are shipped with food to the field laboratories for rearing, recording, and preservation. From 5,000 to 10,000 rearings may be made at a time at any laboratory, with some laboratories making 25,000 rearings per year. In the permanent plots the technique is the same except that the same trees are sampled 2 to 3 times per year, year after year.

Rearing at the laboratories is done to determine the insects' identity, life history, host-parasite relationship, occurrence of disease, population trend (especially during low intensities), and control needs in any one area.

The survey equipment for each insect ranger consists of (1) a 1/2 ton panel truck, (2) and/or house trailer, (3) equipment for clipping twigs at great heights (aluminum ladders, pole pruners). On the Pacific Coast operating out of Victoria is the M. V. "J. M. Swaine", a 61-foot survey vessel used during the summer months for insect surveys of the British Columbia coastal forests. Two years needed to survey full coastline of British Columbia and Vancouver Island. The vessel is modern in every respect and carries a 7-man crew made up of a captain, cook, 4 insect rangers, and 1 insect laboratory technician. The rangers operate in a fashion similar to the interior rangers except that they operate only along the coastline of the mainland offshore islands.

Insect ranger qualifications: high school education, woods experience, some knowledge of forest insects. They are given a 1-year training course and permanently assigned to a definite forest district. There is little turnover in personnel, due, in part to the permanence of his assignment and to the construction of ranger stations to accommodate the ranger and his family.

Insect identification is handled by a systematic unit in Ottawa, but men are being trained to do this work at the field

laboratories. Tree nurseries are maintained at ranger stations to supply food to insects being reared. Adult insects reared at the laboratories are pickled for the insect collection while immature forms are inflated.

Annual printed insect survey reports are prepared for the entire Dominion. Interim reports are mimeographed to cover special insect outbreaks. The data upon which the reports are based are prepared by the laboratories from voluminous records placed on IBM punch cards for ease in sorting. Unusual outbreaks of insects are surveyed separately to gain quantitative information about the damage. This is done by running cruise strips through the infested area. Personnel for this work is often detailed to the laboratories from co-operating forestry agencies. Airplanes also used on a charter basis.

A growing use of the insect survey is the use of indicator insects to forecast the build-up of primary insect populations. Example: blackheaded budworm (Acleris variana Fern.) and hemlock sawfly (Neodiprion tsugae Midd.) population increase precedes that of the hemlock looper (Lambdina fiscellaria Guen.).

(Graham) The Canadian survey organization sounds quite large for a detection service. Actually, it provides much information for research on parasitism, insect pathology, distribution, alternative hosts, what happens to populations and their natural control factors during endemic and epidemic periods, the rate and direction of intestation build-ups, and silvicultural management plans for insect control.

(Orr) The U. S. survey objectives place the emphasis on getting data upon which to plan control work. Less important is the limited research value of the data. The forest Pest Control Act of 1947, however, allows an increase in survey activities for reasons other than as a prerequisite to control.

Oregon and Washington (Mr. John M. Whiteside)

Aerial surveys are being used to supplement ground surveys. The aerial survey crews aim at the detection of all insect-caused forest damage visible from the air. Where important damage is first observed from the air, ground crews are later sent to the area to obtain quantitative or qualitative data. Sometimes damage observed from the air is mistakingly identified as insect-caused, but good observers soon learn the characteristics of non-insect caused tree damage. The 1950 aerial survey disclosed 65,000 acres of young Douglas fir in the Olympic Peninsula (Washington) subsequently determined to have been damaged by bears.

Ground surveys have employed 320-acre check plots since 1920 to sample ponderosa pine mortality from western pine beetle attacks. These

plots have also yielded considerable data of research data, notably that used as the basis for the Keen susceptibility classification. No efficient ground sampling techniques have been worked out yet for the determination of bark beetle-caused losses in the dense coastal forest of Douglas fir.

(Jenicke) The ponderosa pine ground survey has provided benefits other than current mortality from bark beetles; namely, (1) population trends, (2) a basis for silvicultural timber marking rules, (3) a basis for sound forest management practices. For a number of years these surveys were financed from Forest Service insect control funds. Always responsible for the technical supervision of the surveys, the Bureau of Entomology and Plant Quarantine is operating an enlarged programme under direct financing from Forest Pest Control Act funds.

California (Mr. George R. Struble)

Surveys in California are primarily to detect new bark beetle outbreaks and to appraise the status of current infestations. All forested sections of the state have been divided into geographical subregions wherein infestation conditions can be covered more adequately. The redwood forests of the north coastal region are eliminated from the annual forest insect surveys because they are immune to primary insect attack.

Most of the surveys are "red top" surveys, i. e., they rely on faded foliage to indicate the location and number of infested trees in the stands. Ground surveys employ semi-permanent check areas, either rectangular or the more recently developed roadside plots, as well as red top counts from roads and vantage points for a year-to-year record of beetle-caused tree mortality. Aerial reconnaissance is used to detect outbreaks in inaccessible country or to denote where ground coverage is needed.

Central Rocky Mountains (Dr. B. H. Wilford)

Forest insect surveys in this region are of a reconnaissance type involving the co-operation of land-managing agencies. Forest Service and National Park Service rangers are relied upon in many instances to provide initial information of new insect outbreaks. Aerial surveys have not been satisfactory in locating and appraising Engelmann spruce beetle infestations because the lack of foliage fading of infested trees renders them invisible from the air in many cases. Intensive ground surveys employ continuous cruise or sample strips through the host type to determine the percentage of mortality or damage in insect attacked stands. Strips employed almost solely for bark beetle infestations. Surveys are difficult to conduct because of a lack of detailed forest resource data - adequate cultural or topographic maps, timber type maps, timber volume estimates, etc.

(Wygant) Most surveys in the region are pre-control in nature. Present surveys stress the damage caused by a given insect as a basis for control. There is a need for more insect population data from the surveys.

(Parker) The Division of Forest Insect Investigations of the Bureau of Entomology and Plant Quarantine has recently appointed a new assistant Division leader in charge of forest insect surveys. The Division's survey programme is now operating in 8 of the 9 Forest Service regions of the United States. An expanded programme of surveys is needed in most regions to cope with pressing insect problems. The fact that control needs influence the surveys in the United States is evidenced by the fact that the survey effort is aimed at obtaining information of emergency outbreaks.

(Richmond) Canadian and U. S. surveys are similar since in the final analysis both are directed at the control of injurious forest insects.

(Jaenicke) It is a fact that in the U. S. the Forest Pest Control Act definitely ties surveys to control. Surveys perhaps should be financed on the merits of the surveys themselves.

(Parker) It may take a few years for surveys to be planned as a distinct function apart from control needs, but this may come eventually.

Idaho and Montana (Mr. Philip C. Johnson)

In this region, known in the U. S. as the Northern Rocky Mountain Region, surveys operated annually by the forest insect laboratory at Coeur d'Alene (Idaho) are primarily for the detection and appraisal of bark beetle outbreaks. Special surveys are operated as required for infrequent defoliator insect outbreaks. The programme relies heavily upon co-operators, principally for detection information. Because the personnel of the co-operating forest and park agencies is extremely insect conscious, many reports are received by the laboratory each year describing forest damage attributable to insects. Changes in the status of older infestations are also frequently reported.

Reports of potentially serious tree damage are followed up with field examinations by forest entomologists from the Coeur d'Alene laboratory. Where a serious infestation is found to be building up in a commercial or recreational forest, specially-trained survey crews are brought in by the laboratory to make a quantitative appraisal of the damage from which control recommendations can be made. These crews are also deployed annually in high value forests, notably the western white pine stands of northern Idaho, to record tree mortality from mountain pine beetle infestations that may be present in varying degrees of severity.

The crews vary from 3 to 5 men composed of one crew chief, the remainder being strip runners. The crew chief is responsible for the proper

sampling, by continuous strips, of the infested stands. The strips are run parallel to each other and close enough to give a 1¼, 2½, 5, or 10 per cent sample of the forest type being examined. The strips are run on predetermined compass bearings, usually across drainages, and are one chain wide. Each strip is run by a single man who tallies all currently-infested trees on the strip while sketching in on a small strip map such things as topography, timber type, streams, ridges, roads, and trails. As a safety measure and to facilitate checking of the strip, the strip runner lays a string line behind him from a small belt reel fastened to his back. Fastened to the string at 20-chain intervals are shipping tags giving the strip number, distance from starting point, direction of travel, and the runner's name.

Approximately $1,000.00 of survey funds are expended yearly in this region for the rental of government-contract airplanes and pilots for aerial reconnaissance. This is to detect insect outbreaks in the more inaccessible country or to define the limits of known outbreaks as an aid to subsequent ground examinations. The aerial surveys are especially valuable in examining forest areas infested with defoliating insects.

Intermountain Region (Mr. Leslie W. Orr)

The surveys in this region follow the practice of those in the Idaho-Montana and the Colorado regions. The programme of surveys is geared to detect controllable infestations in their incipiency. The annual feature of the programme will make the forest insect surveys less dependent upon the control needs of the region. As a result, more data of value to research may be realized and forest management objectives will be better served.

(Parker) It is significant that the increase in survey programmes throughout the west in 1949 and 1950 came during a period of heavy forest insect damage.

Special Survey Problems (Prof. Kenneth Graham)

Black-headed budworm, Vancouver Island, 1940-44. A survey made in the autumn of 1944 showed that the budworm population was declining due to egg parasitism. Additional sampling in the spring of 1945 showed still further decline. Therefore, on the basis of this information, planned control measures were abandoned. In general, the problem of measuring defoliator populations accurately is very difficult. Surveys aim to get an objective measurement of the population. Sampling populations by frass sampling has been tried. The amount of frass produced is usually proportional to the number of insects feeding in the crown. The rate of frass production parallels the rate of dry weight larval development.

(Jaenicke) The amount of defoliator insect mortality caused by control measures can be determined quite adequately from pre- and post-control measurements of frass droppings.

Current Forest Insect Research

(Mr. D. E. Parker, Discussion Leader)

Time permitted little more than a listing of the forest insect research work in progress in the forest insect laboratories, colleges, and universities of the western U. S. and Canada. Following is a brief resume of the more important work mentioned.

British Columbia (Mr. Hector A. Richmond)

1. Timber deterioration following hemlock looper outbreaks.
2. Insect pests of forest nurseries and plantations.
3. Seed and cone insects.
4. Sitka spruce weevil studies, Pissodes sitchensis Hopk.
5. Insect problems associated with the flooding of timber.
6. Spruce budworm biology and genetics of the 2-year cycle phase.
7. Engelmann spruce beetle, life history and habits associated with selection cuttings in spruce.
8. Forest survey techniques.
9. Studies in the rise and decline of insect populations.
10. Frass sampling studies of the hemlock and oak looper.
11. Ambrosia beetles; mill studies of lumber degrade caused by them, chemical controls, and methods of preventing attacks.

Canadian forest insect research is not under the pressure of control work.

Alberta (Mr. George R. Hopping)

1. Studies of the epidemiology of the lodgepole pine needle miner.
2. Silvicultural factors associated with the rise and fall of spruce budworm infestations.
3. Studies of selection cuttings to improve the vigor and resistance to insects of national park timber stands.

Biological Control Laboratory, Vancouver, B. C. (Dr. A. B. Baird)

The laboratory is conducting parasite and predator studies as follows:

1. Determination of western Canada parasites and predators suitable for establishment in eastern Canada.

2. Studies of spiders as an important natural control factor for spruce budworm in the Lillooet River area.

3. Studies of the possible importation into western Canada of natural control factors believed responsible for holding in check active infestations of lodgepole pine needle miner in Idaho and California.

4. Transportation of hemlock looper parasites into Newfoundland.

The State College of Washington (Dr. Maurice T. James)

1. Studies of dipterous forms associated with bark beetle populations under the bark of infested trees.

2. Parasite and predators studies of tent caterpillars in western Washington.

Colorado A & M College (Prof. T. O. Thatcher)

1. Studies of the identification characters of Ips larvae.

2. Genetic testing; cross-breeding of Dendroctonus monticolae Hopk. and D. ponderosae Hopk., conducted by Mr. Cyrus J. Hay, graduate student.

Division of Forest Insect Investigations (Mr. Donald E. Parker)

Division research work projects are currently being conducted on various phases of problems associated with (1) bark beetles, (2) defoliating, boring, and sucking insects, (3) forest products insects, (4) insect vectors of forest diseases, and (5) spruce budworm. The fact that the Division's research programme is directly tied to the need for advice on control is a recognized weakness of the programme, but under the circumstances it is necessary.

California (Mr. George R. Struble)

1. Biological and ecological factors associated with Ips outbreaks.

2. Climatic factors associated with bark beetle outbreaks.

3. Primary damage by secondary insects in southern California.

4. Studies of the susceptibility of hybrid pine strains to attacks of Cylindrocopturus spp.

5. Dendroctonus brevicomis attack tests on larger Coulter pine-ponderosa pine hybrid trees.

6. Apparent lack of tree selection trait on the part of D. brevicomis Lec. in ponderosa pine forests along the western slope of the Cascade-Sierra Nevada range.

7. Same for D. monticolae Hopk. in sugar pine.

Central Rocky Mountains (Dr. Noel D. Wygant)

1. Biology of the Engelmann spruce beetle.

2. Chemical control of bark beetles by water emulsions of ethylene dibromide, particularly for the control of Dendroctonus engelmanni Hopk. and D. ponderosae Hopk.

3. Possibility of nematodes as an effective natural control agent for D. engelmanni Hopk.

4. Residual spray tests with Dieldrin for D. engelmanni Hopk.

Intermountain Region (Mr. Leslie W. Orr)

1. Tests of the application of ethylene dibromide emulsions to control Dendroctonus monticolae Hopk. in lodgepole pine.

Oregon and Washington (Mr. John M. Whiteside)

1. Pseudohylesinus life history and habits.

2. Sitka spruce weevil control methods.

3. Ambrosia beetle control by the use of benzene hexachloride.

4. Spruce budworm control techniques.

5. Spruce budworm over-winter population studies.

6. Spruce budworm biology.

7. Improvement in aerial survey methods in the ponderosa pine sub-region.

8. Tree mortality studies in south-western Oregon Douglas fir stands from Dendroctonus pseudotsugae Hopk., and the fungus Poria weirii Murr.

9. Studies of methods of cutting as they affect subsequent ponderosa pine mortality from bark beetles.

Idaho and Montana (Mr. Galen C. Trestle)

1. Control of post-logging Ips oregoni outbreaks by slash disposal methods.

2. The role of the black pine leaf scale, Nuculaspis californica (Coleman), in the so-called Spokane ponderosa pine blight.

3. Tests of bark penetrating insecticides for control of the Douglas fir beetle.

4. Bark beetle and wood borer problems associated with wind felled coniferous forests.

5. Insects affecting pole production.

6. Tests of the effectiveness of the ponderosa pine risk rating system in this region.

7. Studies to determine the necessity for controlling the spruce budworm in the Rocky Mountains.

FINAL BUSINESS SESSION

Saturday afternoon, December 16, 1950.

The nominating committee proposed the name of Mr. R. L. Furniss, Entomologist in Charge, USDA Forest Insect Laboratory, Portland, Oregon, to succeed Mr. A. J. Jaenicke as one of the three Counsellors. Mr. Hopping moved the nominations be closed and that a unanimous ballot be cast for Mr. Furniss. Mr. Thatcher seconded the motion. Mr. Furniss was thus elected to serve a 3-year term as Counsellor.

Following some discussion, the matter of increasing the Conference to a 3-day meeting was referred to the Executive Committee to be decided prior to the 1951 Conference. Chairman Richmond suggested that large-scale maps be brought to the next conference showing the geographic features of the working regions, provinces, and states represented by the membership.

Following an expression of appreciation to Dr. Wygant and the staff of the Fort Collins laboratory for their fine work as hosts, the first annual Western Forest Insect Work Conference was adjourned at 5:30 P. M.

Respectfully submitted,

Philip C. Johnson
Secretary-Treasurer.

ATTENDANCE ROSTER

FIRST ANNUAL

WESTERN FOREST INSECT WORK CONFERENCE

Fort Collins, Colorado

December 15-16, 1950.

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Division of Entomology
Science Service
OTTAWA, ONTARIO.

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Colorado A & M College
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FRED C. BISHOPP, Asst. Chief
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E R R A T U M

The following names were inadvertantly ommitted from the roster of those attending the 1950 Conference in Fort Collins:

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